

REMARKS/ARGUMENTS

Claims 1-20 are active in this application. Support for the amendment to Claim 1 is found on page 3, lines 13-14. Claim 6 has been amended for clarity. Support for the amendment to Claim 8 is found on page 3, lines 13-14. Support for Claims 9 and 10 is found on page 3, lines 48-53. Support for Claims 11-20 is found on page 1, lines 9-12; page 7, lines 14-17 and Claims 1-10. No new matter is added by these amendments. Favorable reconsideration is respectfully requested.

The present invention is based on the method for producing a saponified ethylene-vinyl acetate copolymer which is performed in an alcohol-based solvent in the presence of an alkali catalyst which polymer has an ethylene content of not more than 55 mol% and wherein 100 ppm to 15,000 ppm of water is added to the alcohol-based solvent. This provides an improved yield of the saponified EVOH. This method is not described in the prior art cited by the Examiner for the following reasons.

Moritani et al. describe a method for producing EVOH and subsequent saponification of the EVOH. However, Moritani et al. do not add water to the saponification reaction but is added after the saponification reaction is complete.

See column 12, Example 8 of Moritani et al. which describes that “a methanolic solution obtained by adding 1 part by weight of sodium hydroxide to 100 parts by weight of the thus obtained copolymer solution was saponified for 30 minutes at 110°C., the .5 kg/cm², while methanol vapor was being blown int.” (column 12, lines 24-28)—this is the saponification reaction. Moritani et al. then describes “into the obtained saponification mixture, water-methanol was further blown, distilled mixed vapor of methanol-water, whereby a 35% by weight solution of the saponified product of the copolymer and a mixed solvent of methanol water (methanol/water = 65/35 by weight) was obtained” (column 12, lines 30-62). Therefore, it is clear that Moritani et al. add water after the saponification and

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as such Moritani et al. does not describe adding 100 ppm to 15,000 ppm of water into the alcohol-based solvent during the saponification of an ethylene-vinyl acetate copolymer as in the present claims.

In view of the above, the present claims are not anticipated by Moritani et al. and similarly would not have been obvious in view of Moritani et al. Withdrawal of this ground of rejection is requested.

The rejections of Claims 1 and 4-8 under 35 U.S.C. § 102(b) or 35 U.S.C. § 103(a) over Plambeck, Hart et al., Hori et al. or JP6345811 are respectfully traversed because Plambeck uses an aqueous dispersion for saponification and the other three describe EVOH with higher ethylene content than the copolymer in the present claims. Applicants describe in the specification the importance of not using a copolymer with high levels of ethylene on pages 2-3 of the specification. In particular, if the ethylene content is too high, the gas barrier properties of the EVOH molded product are decreased (see the paragraph bridging pages 2-3 and the second paragraph on page 3).

Plambeck describes a method for saponifying ethylene-vinyl acetate. However, unlike the present saponifying reaction which is performed in an alcohol-based solvent, Plambeck describes that the reaction is performed in an aqueous dispersion, i.e., a water-based solution (see col. 3, lines 4-6, lines 70-74, col. 6, lines 38-45).

The examples in the present application support the importance of utilizing a alcohol-based solvent with limited amounts of water added thereto. In particular, Applicants direct the Examiner's attention to Examples 1, 2 and 3 which utilize water content of about 1,500 ppm (Example 1), 1,500 ppm (Example 2), and 5,000 ppm (Example 3). In each of these examples a saponified EVOH was obtained at a high yield. Contrast these results with the results obtained in the Comparative Example 2 on page 8 of the specification where the water content with respect to the EVOH was about 30,000 ppm. As stated on page 9, lines 12-14

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"However, because the rate of saponification reaction was extremely slow, the saponification had to be discontinued."

As a result the present claims are neither anticipated by or would have been obvious in view of Plambeck.

Hart, Hori and JP6345811 utilize ethylene-vinyl acetate copolymer with high levels of ethylene which is not the same as the ethylene content in the present claims: "wherein the ethylene content and the ethylene-vinyl acetate copolymer is not more than 55 mol%" (Claim 1). As referred to above and discussed in the specification on pages 2-3, the amount of ethylene in the copolymer has a profound affect on the resultant product.

Hart describes in column 6, lines 24-27 "Generally, these polymers contain from 3-45 mol% and preferably 15-25 mol% vinyl ester and the balance ethylene." Thus, the amount of ethylene in the copolymer ranges from 55-97 mol% ethylene (see also Claim 4 of Hart which states the polymer contains about 75-85 mol% ethylene). Thus, the entirety of the description of Hart is, in fact, the opposite of what is claimed, i.e., not more than 55mol%.

Hori describes using an ethylene-vinyl acetate copolymer with a vinyl acetate content of about 20-50 wt.% (col. 4, lines 27-29 and lines 51-52). Calculating the relative mol% based on 50 wt% of vinyl acetate the approximate mol% of the each monomer in the Hori copolymer is 75 mol% of ethylene and 25 mol% of vinyl acetate.¹ Calculating the mol% of ethylene when the vinyl acetate content is 20wt% would be even higher.

¹ In 1 g of polymer where the vinyl acetate is present at 50wt% :1 g polymer= $\frac{1}{2}$ g vinyl acetate and $\frac{1}{2}$ gram ethylene

MW of polyethylene is ~28 g/mol and therefore the moles of ethylene is $0.5\text{g} / 28\text{g/mol} = 0.018 \text{ mol}$

MW of vinyl acetate is ~86 g/mol and therefore the moles of vinyl acetate is $0.5 \text{ g} / 86\text{g/mol} = 0.006 \text{ mol}$

Total moles= $0.018 \text{ mol (ethylene)} + 0.006 \text{ mol (vinyl acetate)} = 0.024 \text{ mol}$

mol% of ethylene is $0.018 / 0.024 \text{ mol} = 75 \text{ mol\%}$

mol% of vinyl acetate is $0.006 / 0.024 = 25 \text{ mol\%}$

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Furthermore, in the examples in columns 11, 12 and 13 of Hori the vinyl content exemplified ranges from 6.8 to 9.6 mol% meaning that there is more than 90mol% ethylene content in the copolymer. Therefore, the present claims which use a EVOH with an ethylene content of not more than 55 mol% is not anticipated by or would have been obvious in view of Hori et al.

Similarly, JP6345811 describes saponifying an ethylene-vinyl acetate copolymer with the vinyl acetate content is 10-50 wt.% (Abstract). As noted in the discussion of Hori above, this equates to 75mol% or more of ethylene in the copolymer. Therefore, the present claims are not anticipated by or would have been obvious in view of JP6345811.

In view of the foregoing withdrawal of the rejections over Plambeck, Hart et al., Hori et al. and JP6345811 is requested.

The rejection of Claim 6 under 35 U.S.C. § 112, second paragraph is addressed by amendment.

An notice of allowance is requested. Early notification of such allowance is requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



Norman F. Oblon
Attorney of Record
Registration No. 25,599



22850

Tel: (703) 413-3000
Fax: (703) 413 -2220

Daniel J. Pereira, Ph.D.
Registration No. 45,518